Total No. of Questions : 12]

SEAT No. :

P1622

[Total No. of Pages :3

[5058]-68
T.E. (Electrical)
DESIGN OF ELECTRICAL MACHINES
(2008 Course) (303148) (Semester - II)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 from section - I and Q7 or Q8, Q9 or Q10, Q11 or Q12 from section - II.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain principle components of leakage flux for polyphase machines. **[8]**

b) Explain rotating hysteresis and pulsation losses in electrical machines. **[8]**

OR

Q2) a) Explain Carter's fringe curves and air gap flux distribution factor in detail. **[8]**

b) Define **[8]**

i) Leakage coefficient

ii) Window space factor

iii) Stacking Factor

iv) Real Flux density

Q3) a) Derive output equation of three phase transformer. **[8]**

b) Calculate the specific iron loss in a specimen of alloy steel for a maximum flux density on 3.2 Wb/m^2 and frequency of 50 Hz, using 0.5 mm thick sheets. The resistivity of alloy steel is 0.3×10^{-6} Ω–m. The density is 7.8×10^3 kg/m^2. Hysteresis loss in each cycle is 400 J/m^3. **[8]**

OR

P.T.O.

Q4) a) Explain specifications of transformer as per IS 2026. **[8]**

b) Draw heating curve and cooling curve. Define the heating time constant, cooling time constant and discuss the concept of final steady termperature rise. **[8]**

Q5) a) Explain why the distribution transformers are designed for high all day efficiency. **[6]**

b) Determine the main dimensions of core, yoke, number of turns of primary and secondary windings and the cross section of the conductors for a 5kVA, 11000/400v, 50Hz, single phase core type transformer, the net conductor area in the window is 0.5 times the net cross section of iron in the core. Assume square cross section for the core with following parameters: Maximum flux density = 1.2T, widow space factor = 0.2, current density = 1.2A/mm^2, stacking factor 0.9. The height of window is 3 times width of window. **[12]**

OR

Q6) a) Explain the process of design of cooling tubes of a transformer. **[8]**

b) Explain the procedure to estimate active and reactive components of no load current of single phase core type transformer. **[10]**

SECTION - II

Q7) a) Explain the fractional slot winding used for stator of three phase induction motor. What are the advantages of fractional slot winding? **[9]**

b) Draw developed diagram of stator winding of a three phase, 4 pole synchronous machine. The winding is of lap type and with double layer with a phase spread of 600. The winding is short pitched by one slot; there are three slots per pole phase on the stator. **[9]**

OR

Q8) a) Discuss factor which govern the choice of electrical loading and specific magnetic loading. **[8]**

b) Determine the main dimensions, number of radial ventilating ducts, number of stator slots and the number turns per phase of a 3.7kW, 400V, 3-phase, 4-pole, 50Hz, squirrel cage induction motor to be started by a star - delta starter. Work out the winding details. Assume : Average flux density in the gap = 0.45 Wb/m^2, ampere conductors per meter = 23,000, efficiency = 0.85 and p.f. = 0.84. Machines rated at 3.7 kW, 4-pole is sold at a competitive price and therefore choose the main dimensions to give the cheap design. Assume: Winding factor = 0.955, Stacking factor = 0.9 and slots per pole per phase = 3. Assume, $L/\tau = 1.5$ for cheap design. **[10]**

Q9) a) Discuss harmonic induction torques and harmonic synchronous torques produced by harmonic fields in three phase induction motor. **[8]**

b) Give step by step procedure to design squirrel cage rotor of star connected three phase induction motor. **[8]**

OR

Q10)a) Discuss the importance of suitable combinations of stator and rotor slots in case of three phase induction motor. **[8]**

b) Derive the equation for end ring current for the rotor of squirrel cage induction motor. **[8]**

Q11)a) Explain effect of saturation of performance of three phase induction motor. **[5]**

b) Explain the method of calculation of magnetizing current of three phase induction motor considering. **[11]**

i) MMF for air gap

ii) MMF for stator teeth

iii) MMF for rotor teeth

iv) MMF for stator core

OR

Q12)a) Draw a neat sketch of a magnetic circuit of three phase four pole induction motor. Clearly indicate: **[8]**

i) Rotor core

ii) Rotor teeth

iii) Air gap

iv) Stator core and teeth

b) Discuss various losses in case of three phase induction motor. **[8]**